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IS 4938 (2009): Insulated Stainless Steel Milk Storage Tanks, Vertical Type - Specification [FAD 19: Dairy Products and Equipment]



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“Knowledge is such a treasure which cannot be stolen”

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भंडारण टैंक — विशिष्टि

1/4 पहला पुनरीक्षण 1/2

Indian Standard

INSULATED STAINLESS STEEL MILK STORAGE
TANK, VERTICAL TYPE — SPECIFICATION

(First Revision)

ICS 67.260

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Dairy Products and Equipment Sectional Committee had been approved by the Food and Agriculture Division Council.

The insulated stainless steel milk storage tanks are widely used to store milk and liquid milk products which have already been cooled. These storage tanks are required to hold the products without any appreciable rise in the product temperature. There are two types of such tanks, namely, horizontal tanks and vertical cylindrical tanks. IS 2688 : 2008 'Insulated stainless steel horizontal milk storage tanks — Specification (*first revision*)' covers specification for insulated stainless steel horizontal milk storage tanks of capacity 5 000, 10 000 and 15 000 litre. This standard covers milk storage tanks of vertical cylindrical shape of capacity 5 000, 10 000 and 15 000 litre. Such tanks are being increasingly used as they occupy less floor space.

The standard was originally published in 1964. This revision has been undertaken to update the specification of milk storage tank with the latest design and requirements.

This standard is intended chiefly to cover the technical provisions relating to insulated stainless steel milk storage tank, and it does not include all the necessary provisions of a contract.

The word 'stainless steel' appearing at various places in this standard shall mean stainless steel conforming to designation X04Cr19Ni9 of IS 6911 : 1992 'Stainless steel plate, sheet and strip — Specification (*first revision*)'. Only Stainless Steel Tungsten Inert Gas (TIG) Arc Welding using AWS ER 308L/ 316L filler metal conforming to IS 2811 : 1987 'Recommendations for manual tungsten inert gas arc welding of austenitic stainless steel (*first revision*)' shall be done for all joints in stainless steel sheet.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

INSULATED STAINLESS STEEL MILK STORAGE TANK, VERTICAL TYPE — SPECIFICATION

(*First Revision*)

1 SCOPE

This standard prescribes the requirements for insulated, stainless steel vertical cylindrical milk storage tanks of 5 000, 10 000 and 15 000 litre capacities.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
325 : 1996	Three phase induction motors — Specification (<i>fifth revision</i>)
3178 : 1996	Abrasive emery grain — Specification (<i>first revision</i>)
6911 : 1992	Stainless steel plate, sheet and strip — Specification (<i>first revision</i>)

3 CAPACITY

3.1 Gross Capacity

The gross capacity is the full capacity of the tank and is 5 to 10 percent more than the rated capacity.

3.2 Rated Capacity

Volume of the inner vessel, when filled upto 100 mm below the line where cylindrical shell joins the conical top, shall be not less than the rated capacity, namely 5 000 litre, 10 000 litre and 15 000 litre.

4 MATERIAL

4.1 The inner and the outer shell and other parts except light and sight glasses and sealing gasket, which come into contact with milk, shall be made of stainless steel conforming to designation X04Cr19Ni9 of IS 6911.

4.2 The insulating material shall be of suitable type such as polyurethane foam and expanded polystyrene.

4.3 Non-metallic material, neoprene or nitrile rubber, etc, may be used in product contact surfaces for sealing and gasketing, provided such material are non-toxic, non-absorbent and corrosion resistant and shall not impart any objectionable odour or flavour when such material come into contact with the milk or the milk products in the tank.

5 SHAPE AND DIMENSIONS

5.1 The tanks shall be of vertical cylindrical shape for the body with flat bottom sloping towards the outlet and conical (15° approximate) top. The tank shall rest on 4 or more suitable sized legs or be directly supported on concrete plinth. Generally, the height of the legs shall not be less than 300 mm. However, variation in leg height, as per the requirement and type of dairy plants, is permitted by arrangement between the supplier and the purchaser.

5.2 The vertical milk storage tanks shall generally conform to the design given in Fig. 1. Dimensions given in the figure are only approximate. Variations in dimensions shall be permitted by arrangement between the supplier and the purchaser, so long as the capacity and the performance requirements are satisfied.

6 FABRICATION

The tank shall be of welded construction.

6.1 Inner Vessel

The cylindrical shell, conical top and flat bottom of the inner vessel shall be formed to shape and welded. All attachments welded to inner vessel shall be of stainless steel. The welded joints shall be finished ground smooth from inside and shall be watertight. All inside stainless steel surfaces of the shell shall have either 2B mill finish (*see* IS 6911) or be polished to 150 grits (*see* IS 3178). The minimum thickness of the inner cylindrical shell, conical top

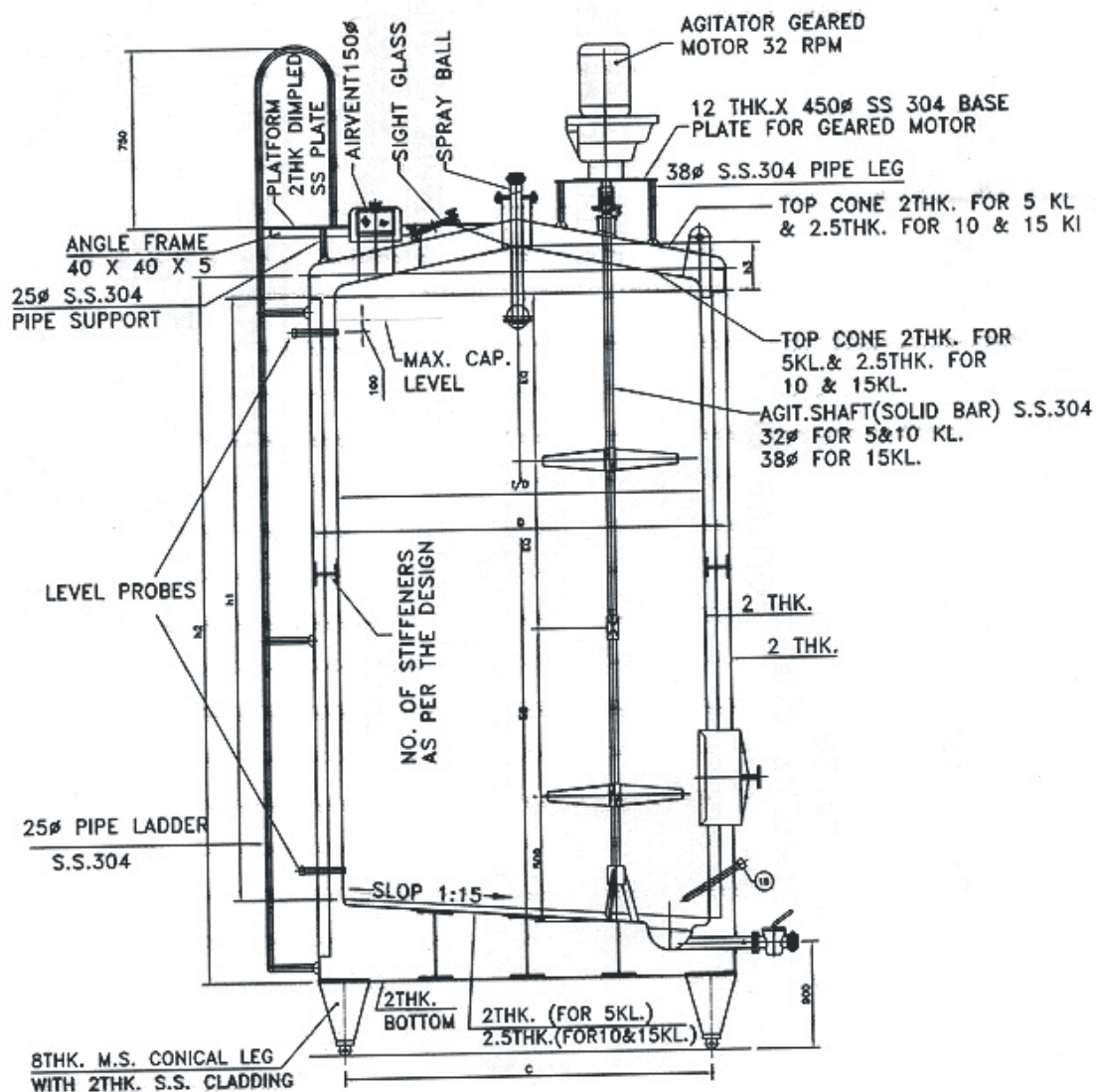
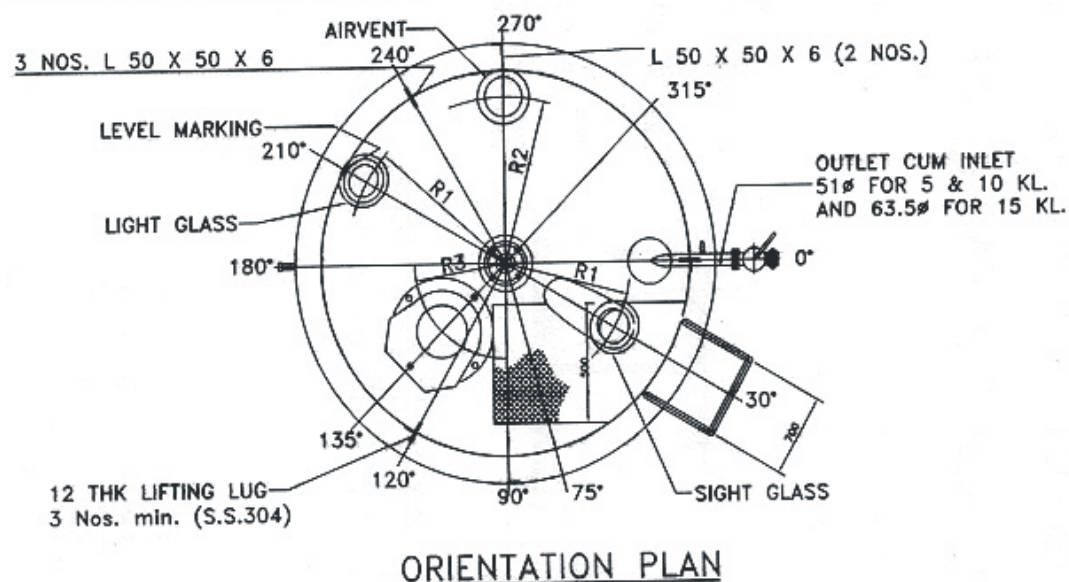


FIG. 1 SECTIONAL ELEVATION OF INSULATED VERTICAL MILK STORAGE TANK, CAPACITY 5 000, 10 000 AND 15 000 LITRE

and flat bottom shall be 2.00 mm, 2.5 mm and 2.5 mm respectively for 10 000 litre and 15 000 litre tanks but 2 mm, 2 mm and 2 mm for 5 000 litre tanks. The inner shell flat bottom shall have a slope of 1:15 towards the outlet of the tank to facilitate drainage of milk to the outlet.

6.2 Outer Shell

The outer shell, conical top and flat bottom shall be fabricated from minimum 2 mm thick stainless steel sheet. The welded joints shall be sound and finished ground smooth from outside. All outside stainless steel surfaces of the shell shall have either 2B mill finish or be polished to 150 grits. The rings for supporting the tanks from its body shall be of mild steel.

6.2.1 MS Stiffeners

Stiffeners between inner and outer shells as well as supporting structure (cradle) for the bottom of the tank shall be provided of mild steel. The cradle provided to the bottom of the tank shall be so designed as to take the weight of the tank when filled with milk. All mild steel used in construction of the milk storage tank shall be painted with two coats of epoxy primer after thorough derusting.

6.2.2 Metal Contact

The construction shall be such that there should be no metal-to-metal contact between the inner and the outer shells except at the places where the fittings and mountings for the tanks are provided. At the places where mild steel stiffeners are provided, insulated padding shall be fixed between the inner stainless steel shell and stiffeners.

6.2.3 Joint Curvatures

The radii of all welded and permanent attachment joints shall be at least 6 mm. The radii where the conical top and flat bottom join the cylindrical shell shall not be less than 25 mm.

6.2.4 Drain Hole

The outer shell shall be provided with one or more drain holes at the lowest point.

6.3 Insulation

The annular space between the inner and the outer shells shall be packed with suitable insulating material such as polyurethane foam and expanded polystyrene etc as given in Fig. 2. The entire stainless steel cylindrical body, flat bottom and conical top of the inner vessel shall be insulated in three layers as follows:

- a) *First layer* — 15 mm thick polyurethane foam insulation of density 30 to 35 kg/m³, applied circumferentially.
- b) *Second layer* — 50 mm thick expanded polystyrene insulation of density 16 to 20 kg/m³, applied longitudinally.
- c) *Third layer* — 50 mm thick expanded polystyrene insulation of density 16 to 20 kg/m³, applied circumferentially.

The insulation shall be applied in staggered joints. All joints shall be sealed with bitumen or CPRX compound. The bitumen or CPRX compound shall be applied uniformly on both the surfaces and all four sides of first and second layers of insulation and on inside surface and all four sides of third layer of insulation.

6.4 Legs

Supporting conical mild steel legs with 2 mm thick stainless steel sheet cladding and stainless steel adjustable stainless steel ball feet, as shown in Fig. 1, shall be provided at the bottom of the tank. The stainless steel ball feet shall have provision for height adjustment of 50 mm. A through hole of approximately 16 diameter shall be provided in the lower portion of ball feet to facilitate their rotation for tank levelling. The legs shall be so designed and spaced as to support the tank, when full, and to keep the milk outlet at a height of 450 mm or as per the agreement between the purchaser and the supplier, from the finished floor level to allow for adequate inspection and cleaning.

7 FITTINGS AND ACCESSORIES

7.1 The tank shall be provided with suitable openings for accessories and fittings as described below and shown in Fig.1. All fittings and mountings (excluding welded on connections and thermowell pocket) and components of agitator, which come into contact with milk in the tank, shall be capable of being easily dismantled for cleaning and sterilizing purposes.

7.1.1 Inlet-cum-Outlet

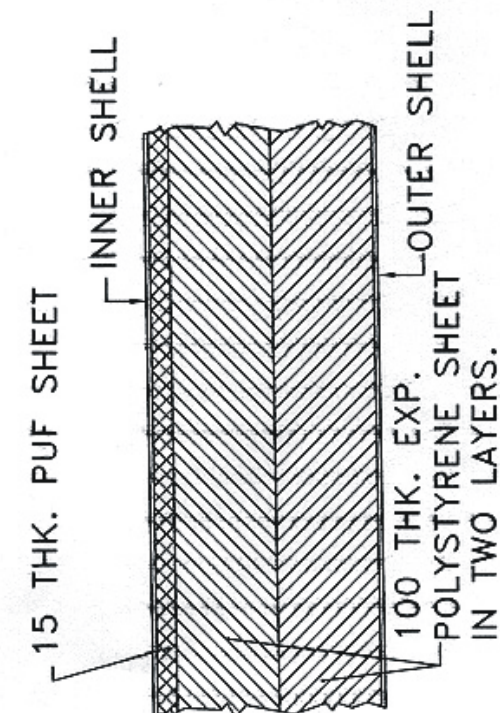
A stainless steel cup welded to the inner shell bottom with a 51 mm diameter outlet pipe for 5 000 litre and 10 000 litre capacity and 63.5 mm diameter for 15 000 litre capacity tanks respectively shall be provided as inlet-cum-outlet.

7.1.2 Outlet Discharge Valve

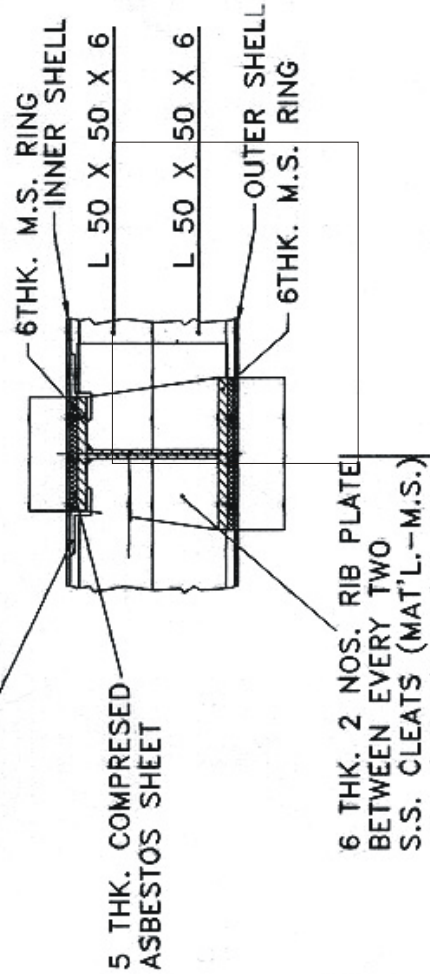
A sanitary design leak proof stainless steel two way plug type or butterfly flanged valve ending in complete stainless steel SMS union at other end, as

DIMENSION TABLE									
CAPACITY	D	I/D	h1	h2	C/C	h3	d2	R1	R2 R3
5000 LTR.	1848	1620	2550	2658	1624	222	48	550	700 400
10000 LTR.	2378	2150	2850	2993	2154	268	48	875	700 400
15000 LTR.	2748	2520	3150	3318	2524	308	54	875	700 400

DIMENSION DETAIL



3 THK. S.S. CLEATS WELDED WITH INNER SHELL
AND '1' SECTION AS SHOWN CENTER TO CENTER
DISTANCE IS 1000 ZIG ZAG FASHION



INSULATION DETAIL

DETAIL OF STIFFENING RING 'I' SECTION

FIG. 2 INSULATED VERTICAL MILK STORAGE TANK DETAILS

shown in Fig. 1, shall be fitted to the inlet-cum-outlet opening. The design and construction of the valve shall be such as to ensure a flush closing with the inner shell and also proper cleaning and hygienic conditions.

7.1.3 *Sampling Cock*

A sanitary design stainless steel sampling cock of size not less than 5.0 mm shall be provided on the outlet nozzle pipe so as to enable samples to be taken even when only 5 percent of the full capacity of the tank is filled.

7.1.4 *Air Vent*

A stainless steel air vent of minimum size 150 mm shall be provided on top of the tank. The vent shall have sufficient free opening area (with wire mesh cover fitted) to prevent formation of partial vacuum during cleaning in place/emptying and pressure build up during filling of the tank. The vent shall be protected from ingress of vermin/insects by removable wire mesh cover. The vent shall also be protected by a hood to prevent any dirt or other particles falling from above. The hood should be bolted down. A stainless steel bracket shall also be provided near the air vent for fixing & hanging rope ladder.

7.1.5 *Manhole*

An oval shaped stainless steel manway of dimensions approximately 550 mm × 405 mm shall be provided at the front end of the tank as shown in Fig 1. The man way shall be provided with a leak proof hinged insulated stainless steel door with tightening and locking device. The manway door shall open inward but at the same time it can also be taken out when necessary. The gasket of the door shall be of endless construction food grade neoprene or nitrile rubber of good quality for airtight closing.

7.1.6 *Opening for Chemical Cleaning*

One number removable type stainless steel chemical cleaning device shall be provided on top of the tank for spraying of cleaning liquid over the complete interior surfaces during CIP and facilitate thorough cleaning. The cleaning device shall have stainless steel unions at the outer end connections. The minimum size of the opening shall be 38 mm. The spraying device shall either be of the fixed ball type or alternatively of the turbine type.

7.1.7 *Mechanical Agitator*

The vertical type mechanical agitator shall consist of a stainless steel shaft and impellers driven by TEFC squirrel cage flanged induction motor with

IP 55 protection and an oil drip proof reduction gearbox as shown in Fig. 1. The mechanical agitator shall run on slow speed, generally around 32 rpm, to ensure non-separation of fat and uniform mixing of milk in the tank within 10 min to enable drawing a truly representative sample from the tank. The agitator shaft shall be made out of a single piece solid rod of stainless steel. Non-metallic parts, if any, coming into contact with the milk shall be made of a material, which has no adverse effect on the milk. The opening for agitator shaft shall be protected against entrance of external matter by providing easily removable fittings of sanitary design. The step bearing provided at the bottom of the vertical shaft agitator shall be so located that it will not interfere with the drainage of the milk from the tank. The agitator shall be of sanitary construction and easily cleanable by spray of cleaning liquid during CIP of tanks refer in 7.1.6. The agitator assembly shall be mounted on stainless steel supporting structure.

Performance of electric motor in general should conform to IS 325. The geared motor should be provided with stainless steel shroud. The shroud shall be easily dismountable and shall have provision for air circulation and cable entry.

7.1.8 *Ladder and Top Platform*

The tank shall be provided, as shown in Fig. 1, with a stainless steel ladder of sturdy construction and design for access to the sight glass and geared motor assembly of agitator. The ladder shall be made of 25 mm stainless steel pipe and welded to the tank. A small working platform made out of minimum 2 mm thick dimple stainless steel plate shall be provided on top of the tank.

7.1.9 *Indicating Thermometer*

The tank shall be provided with a thermometer to indicate the temperature of milk inside tank. A 300 mm long stainless steel inclined thermo well for inserting the bulb of stem type dial thermometer will be welded to the inner as well as outer shells of the tank as shown in Fig. 1. The thermo well shall be made from 25 mm diameter stainless steel pipe with a suitable size boss for the thermometer. The range of the thermometer shall be 0 to 100°C and the minimum graduation in case of dial type analogue thermometer shall be of 2°C. Suitable stainless steel bracket shall be provided for mounting the thermometer on front side of the tank.

7.1.10 *Light and Sight Glass*

One each of light and sight glass assemblies shall be provided with minimum 140 mm diameter toughened glass as shown in Fig. 1. The light glass assembly

shall be provided with stainless steel lampshade and a lamp holder of brass for mounting a lamp suitable to operate on 24 V dc system. The stainless steel sight glass assembly shall be so positioned that one can get the full view of the inside of the tank and easily read from the zero level to the full capacity level mark.

7.1.11 Sand Blasted Level Marks

The tank shall be calibrated for the rated capacity. The full cylindrical part of the tank shall be calibrated in such a manner that there is a clear marking after every 500 litre intervals on the inner shell of the tank at opposite side of the sight glass. The calibration should be done with sand blasted level marks so that the calibrations are clearly visible through the sight glass.

7.1.12 Oil Throw Cup

An oil throw cup or umbrella shall be fitted on a vertical agitator and it shall be fabricated from stainless steel. The cup may also be of moulded rubber with coiled spring for clamping. A cup type stainless steel tray below the oil through cup shall be provided on the shaft for collection of leaking oil and protection.

7.1.13 Lifting Lugs

Minimum 3 number stainless steel lifting lugs of 12 mm thick plate shall be provided at top.

7.1.14 Welding Joints

All welded joints shall be sound, free from porosity and brittleness. The joints of inner vessel from inside and joints of outer shell from outside shall be well ground and finished smooth to 150 grit. Only TIG Welding shall be done for all joints in stainless steel sheet.

7.1.15 All openings in the tanks shall be so made that there is no possibility of accumulation of liquid or other foreign matters and the entrances are protected against dust, insects and other extraneous materials. All components parts shall be capable of being cleaned and inspected in position or by dismantling, if necessary.

7.1.16 Optional Items

An electronic level indicator and high and low level probes may be provided on the tank, if desired by the purchaser. The type and their

mounting arrangement shall be as agreed to between the purchaser and the manufacturer. The opening for electronic level indicator shall be provided with a blind counter flange whereas the level probes openings shall be provided with suitable stainless steel plugs.

8 FINISH

8.1 Finish of Mild Steel Parts

All mild steel supports/stiffeners used in construction of the milk storage tank shall be painted with two coats of epoxy primer after thorough derusting.

8.2 Finish of Stainless Steel Parts

Either 2B mill finish of all the stainless steel surfaces shall be retained or finished smooth by buffing to 150 grit. All welding joints shall also be finished smooth by buffing to 150 grit.

9 TEST

9.1 The inner shell of the tank shall be tested for water tightness in the manufacturer's works after grinding and polishing the surfaces but prior to application of insulation. The tank shall not leak when filled with water upto the brim.

9.2 Dye penetration test shall be conducted for all weld joints of inner shell to ensure no defect.

10 MARKING

10.1 The tank shall be provided with a stainless steel nameplate of size 150 mm × 100 mm fixed on a stainless steel bracket. Following particulars shall be marked legibly and permanently on the name plate:

- a) Manufacturer's trade-mark, name and address;
- b) Manufacturer's identification;
- c) Capacity of the tank; and
- d) Month and year of manufacturing.

10.2 BIS Certification Marking

Each tank may also be marked with the Standard Mark.

10.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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